THE INTENSE PACIFIC COAST STORMS OF OCTOBER 26-28, 1950

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DAMAGE BY THE STORMS

On October 25, the cyclone that became the first of two destructive storms to affect northern California, Oregon, Washington, and Idaho began developing 850 miles west of Portland, Oreg. The strong winds and heavy rainfall that preceded and accompanied the subsequent frontal passages caused widespread damage. All sections of Washington suffered structural damage. The strong winds, with gusts as high as 75 m. p. h., took their usual toll of trees uprooted, power lines downed, and crops damaged. In the Hood River Valley (Oregon) much of the apple crop was blown from the trees. Forty to sixty percent of the seed-clover fields of eastern Oregon were destroyed [1]. Losses caused by wind and rain were estimated at $2,000,000 in Oregon. The heavy rainfall brought harvesting and farming operations to a standstill in Washington, Oregon, and central and northern California. Losses in California, excluding flood damage, exceeded $500,000. In Sacramento, wind damage alone was estimated at $250,000. Some wind damage was suffered in Idaho, but crop damage was small.

Flooding of most streams in western Oregon resulted from the heavy rains. The most serious damage occurred in the Eugene area on the Willamette River, in Douglas County on the Umpqua River and tributaries, in the Grants Pass to Medford area on the Rogue River, and at Myrtle Point and surrounding areas on the Coquille River. The American National Red Cross helped evacuate more than 2,000 families in Oregon and reported several towns isolated for days. Seven persons lost their lives as a result of the floods and strong winds. In California the Eel and Smith Rivers flooded. The Eel River flood, at a stage of 21 feet, was the first on record for so early in the season [2].

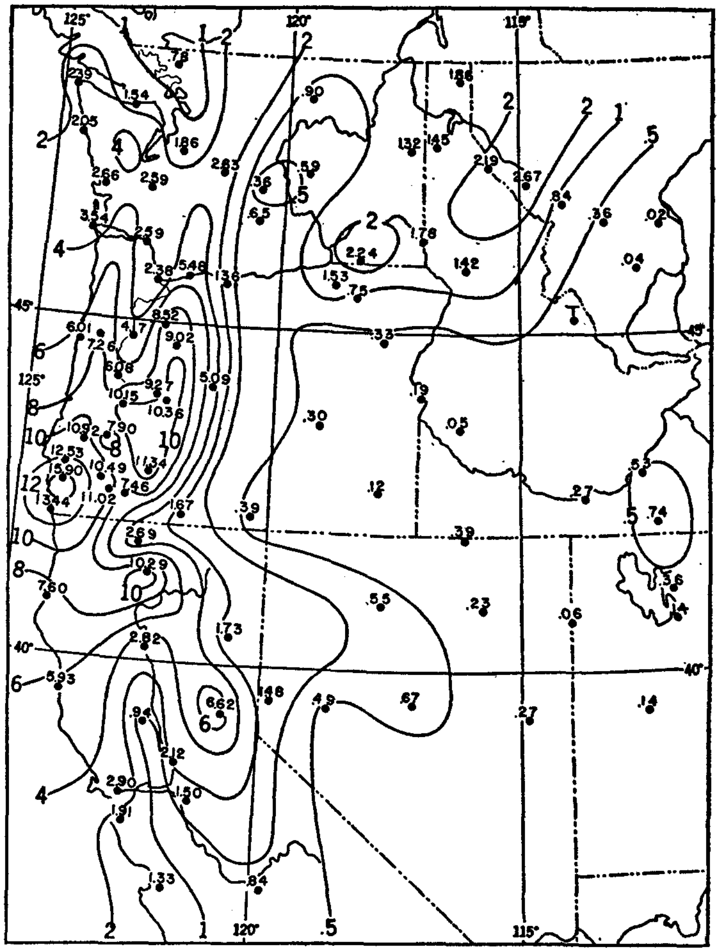

Figure 1.—Total precipitation from 1230 GMT, October 25 to 1230 GMT, October 30, 1950. Values plotted in inches and hundredths. Isohyets labeled in inches.

CLIMATOLOGICAL COMPARISONS

The combined effect of the two major storms and the series of small, stable waves that followed the second storm was to produce daily precipitation in the coastal region for the period October 25–30. Figure 1 illustrates the total rainfall at selected stations in the storm area for that period. (Many other stations received large amounts.) The isohyets were drawn to conform to the pattern revealed on annual average precipitation charts, which reflect the influence of topography [3]. As figure 1 shows, the rainfall of the storms fits the average pattern well with large amounts observed on the western slopes of the Coast and Cascade Ranges and smaller amounts on the eastern slopes and in the principal valleys such as the Willamette and Sacramento. At numerous stations in northern California and Oregon, 10 percent or more of the annual average precipitation occurred during the 5-day period illustrated. At Grants Pass, Oreg., both a new 24-hour and a 48-hour record were obtained, and at Bend, Oreg., 5.88 inches set a new October record. In California, 34 out of 37 stations tabulated received more precipitation in October 1950, than in any other previous October on record. The length of record varied from 4 to more than 60 years. However, it is significant that at Eureka, Calif., and Upper Mattole, Calif., where the record goes back 62 years, the total exceeded the previous October record by more than 4.5 inches. Eureka reported 13.04 inches and Upper Mattole, 25.62 inches. At Gasquet Ranger Station, Calif., 26.10 inches of rain fell during the period October 25–30 and at Eureka a new 24-hour record of 5.83 inches was established [2].

An examination of the Historical Weather Maps [4] from 1899 through 1938, reveals that at the time of the daily charts (1300 GMT) there were only 10 cyclones during October having a central pressure 1,000 mb. or lower in the region bounded by 35° N, 50° N, 135° W and the Pacific Coast. None of these had a central pressure lower than 980 mb. compared to 967 mb. for the first of the October 1950 storms and 970 mb. for the second.

Additional evidence of the unusual intensity of the storms is contained in table 1 which lists some of the stations that reported record low sea level pressures.

Associated with the deep surface low centers were record low temperatures aloft for October. The 500-mb. (5.2 km.) temperature at Tatoosh, Wash., was −31.8° C. at 0300 GMT, October 28. This is 4.8° C. lower than the record 5 km. temperature for the period March 1943–December 1945 [5].

TABLE 1.—*New low sea level pressure records*

Stations reporting all-time record low	Reported low pressure	Years of record	Stations reporting October record low	Reported low pressure	Years of record
WASHINGTON			*WASHINGTON*		
	Mb.			*Mb.*	
Ellensburg	981.0	6	North Head	973.6	17
Olympia	977.3	6	Stevenson	972.9	-----
Port Angeles	973.6	4	Spokane	983.4	70
Stampede Pass	981.4	7	Tacoma	977.7	48
Seattle-Tacoma Airport	977.3	6	Tatoosh	971.6	61
Walla Walla	980.7	65			
Yakima	980.4	32	*OREGON*		
OREGON			Baker	989.2	61
			Meacham	984.1	8
Burns	989.5	2	Medford	984.4	24
Eugene	979.7	6	Portland	979.0	79
Pendleton	981.0	5	Roseburg	981.0	73
Salem	979.7	6	Sexton Summit	982.7	------
CALIFORNIA			*CALIFORNIA*		
Blue Canyon	994.9	2	Eureka	986.8	51
Mount Shasta	984.5	2	Oakland	1,000.7	16
Red Bluff	991.9	63	Sacramento	997.6	74

ANTECEDENT SYNOPTIC CHANGES

In order to study the development of the storms, it is helpful to consider the upper air and surface changes that preceded the first storm. On October 17 and 18 a Low at 500 mb. with a trough trailing southwestward passed south of the weather ship at 50° N, 145° W (Station P). The Low and its accompanying trough moved into the region between 140° W and the United States coast on October 19. There the trough halted and remained until an influx of the much colder air on October 24 and 25.

Those events were naturally accompanied by a change in the direction of flow through the region between 140° W and the North American coast. Figures 2 and 3 show the weak low center that replaced the strong southwesterly

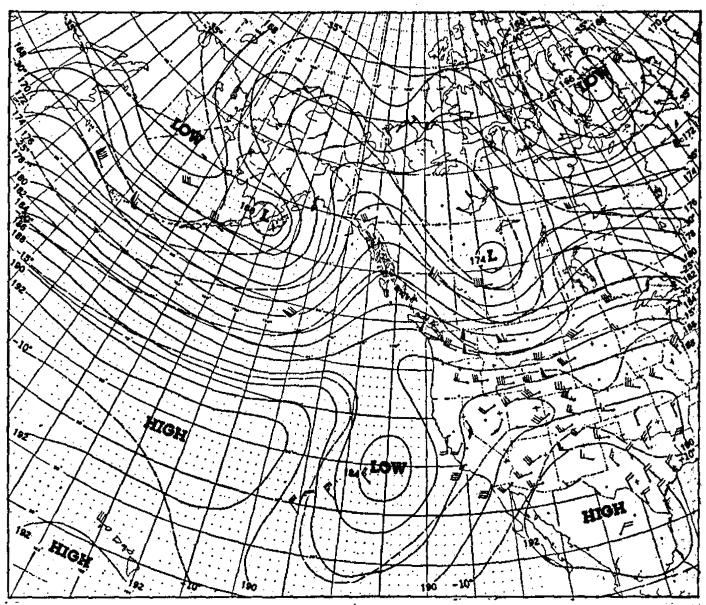

FIGURE 2.—500-mb. chart for 1500 GMT, October 23, 1950. Contours (solid lines) at 100-foot intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are at intervals of 5° C. Barbs on wind shafts are for speeds in knots (pennant=50 knots, full barb=10 knots, and half barb=5 knots).

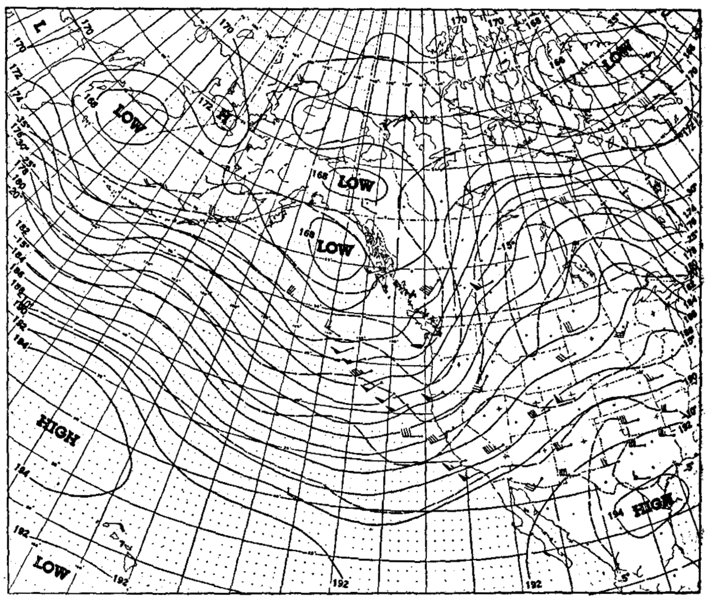

FIGURE 3.—500-mb. chart for 0300 GMT, October 26, 1950.

flow over the Gulf of Alaska and the establishment of a wide stream of westerlies in the region between 140° W and the United States coast. That change helped set up a broad, steering, current from the Aleutian Island region southeastward into the region just west of Washington and Oregon.

On October 22, a mass of very cold air represented by the −30° C. isotherm at 500 mb. moved eastward out of Siberia (fig. 2). By examining the subsequent 500 mb. charts the cold air (progress of the −30° C. isotherm) can

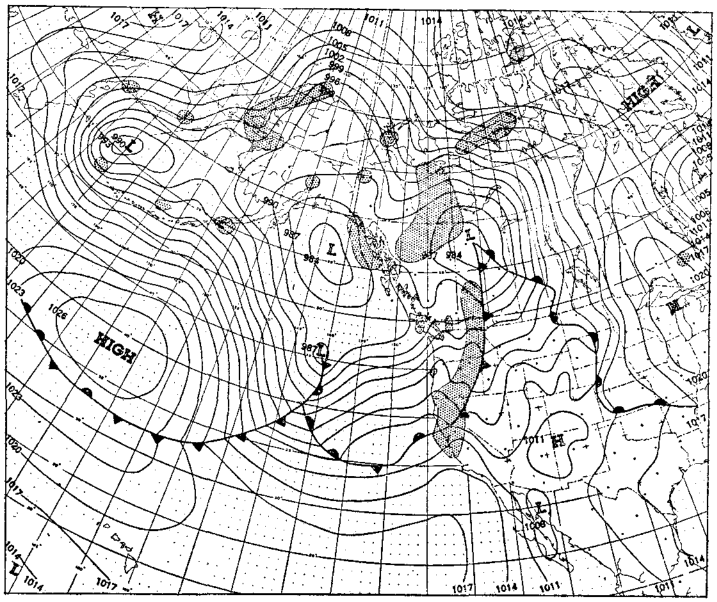

FIGURE 4.—Surface weather chart for 0030 GMT, October 26, 1950. Shading indicates areas of active precipitation.

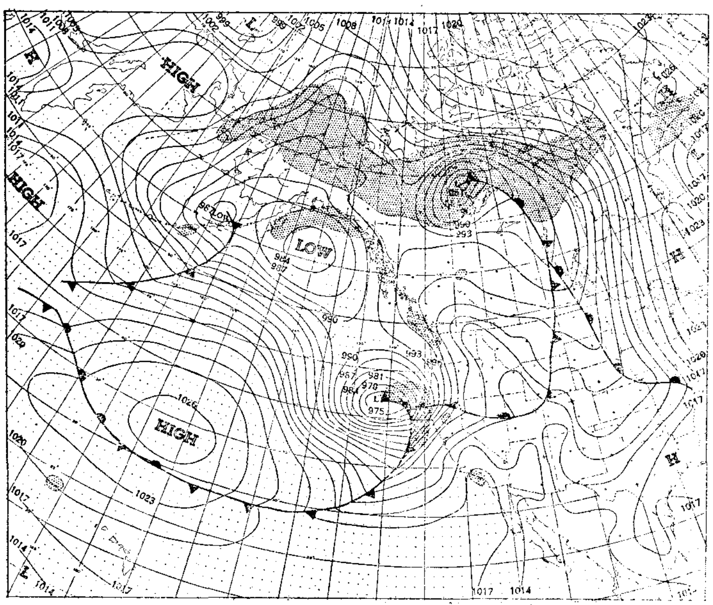

FIGURE 5.—Surface weather chart for 1830 GMT, October 26, 1950.

be followed over the Aleutian Islands, past the weather ship at Station P on October 24, over Tatoosh at 0300 GMT, October 26 (fig. 3), and to Edmonton, Alberta, by 1500 GMT October 26. A comparison of figures 2 and 3 illustrates the upper air change and shows that the temperature in the region just west of Oregon fell from about −16° C. to about −26° C.

Associated with the 500-mb. changes described were marked temperature changes at 200 mb. A large mass of relatively warm air, delineated by the −45° C. isotherm, was brought over the Gulf of Alaska region, and the main stream of the westerlies was directed into the area just west of Washington and Oregon. That situation also helped steer the low centers farther south under the warm air in the stratosphere. The record low pressures that occurred later were partly caused by the warm air above 200 mb. which contributed relatively little weight to the air column, the lower part of which was heavier, colder air compared to the surrounding atmosphere at the same elevations.

The vertical distribution of temperature described here is similar to that found by Vederman [6] in rapidly deepening Lows over the eastern United States.

Prior to the development of the intense storms of October 26–28 a moderately strong cold front at the surface passed through the Pacific Coast States. That front was associated with the antecedent upper air changes described above and is seen in figure 4 extending through Idaho, Oregon, and California. Figure 4 also shows the extent to which the polar front was displaced far southward by the changes described above. The cold air aloft that accompanied the leading cold front is seen in figure 3 as a cold tongue in the isotherms extending along the northwest coast. It is seen that the possibility of additional cooling in the vicinity of 500 mb. with later fronts was small since only slight cold advection was indicated in the weak trough associated with the next front.

The integrated effect of these upper air and surface changes was to establish a large pool of cold air in the lower levels capped by a mass of relatively warm air at high levels and to sharpen the discontinuity over the Pacific at approximately 35° N between the major warm and cold air masses. Those conditions were favorable for the intensification of the Lows that moved into the region later.

SYNOPTIC CONDITIONS DURING STORMS

The first of the intense storms is shown in figure 4 near 45° N, 140° W when it was in an early stage. The low center developed on an old occlusion the northern end of which had frontolized earlier. Eighteen hours after it was first noted, it had moved to a point 400 miles west of Medford and deepened 15 mb. (fig. 5). The speed of the low center was 35 m. p. h. or approximately 70 percent of the wind speed at 500 mb. The cold front associated with the Low reached the Oregon-Northern California coast around 2130 GMT, October 26, and swept rapidly eastward. At the same time, the low center moved northeastward and deepened another 5 mb. to a central value of 967 mb. (fig. 6). By 0300 GMT, October 27, a small closed Low had formed at 500 mb. (fig. 7), and the cold trough associated with the cold front had moved to the coast. The strongest, most damaging winds were experienced on October 26, with the passage of the cold front, and later on October 27. After the frontal passage, the

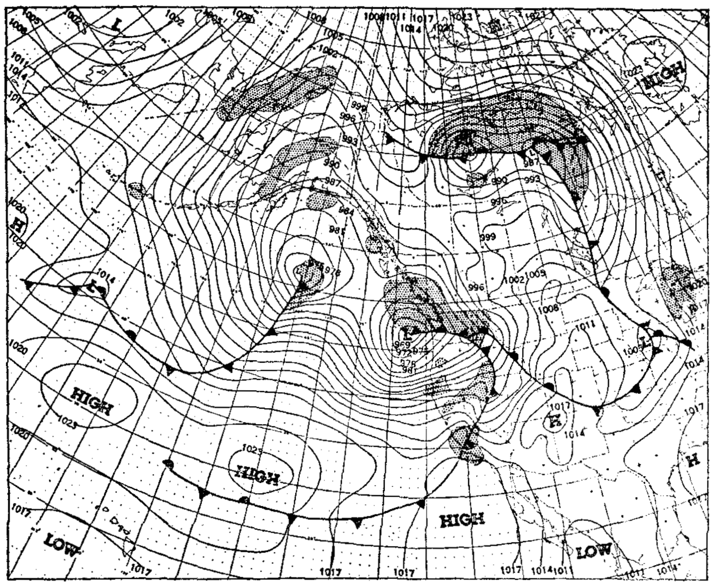

FIGURE 6.—Surface weather chart for 0630 GMT, October 27, 1950.

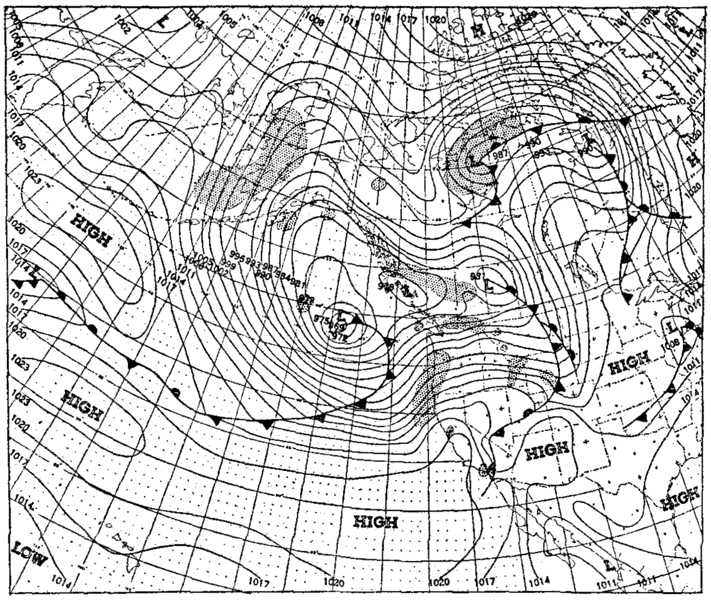

FIGURE 8.—Surface weather chart for 1830 GMT, October 27, 1950.

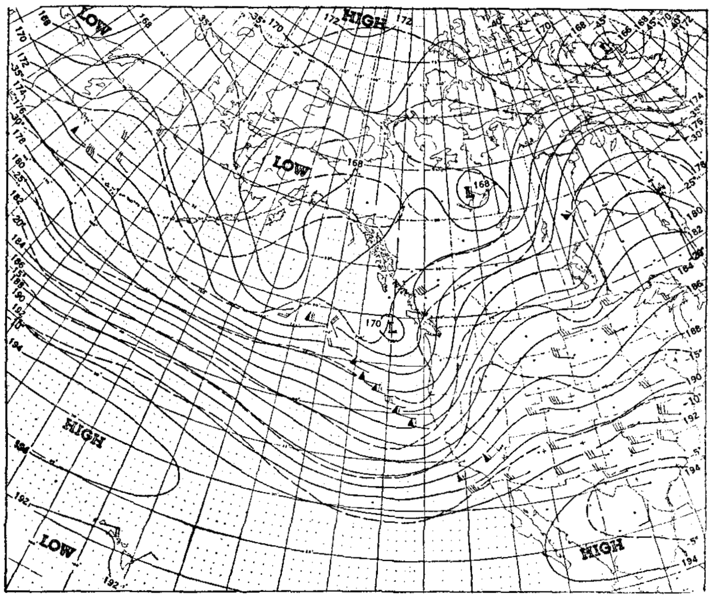

FIGURE 7.—500-mb. chart for 0300 GMT, October 27, 1950.

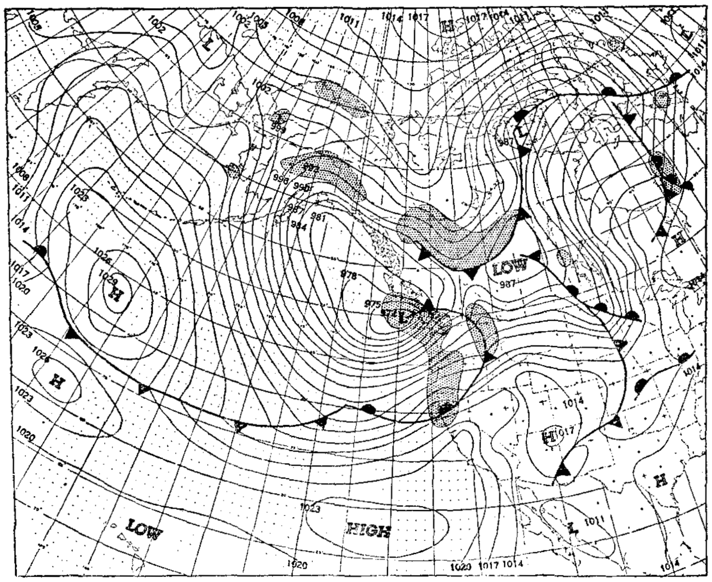

FIGURE 9.—Surface weather chart for 0630 GMT, October 28, 1950.

pressure immediately began to return toward normal. At 1230 GMT and 1530 GMT, October 27, several stations in Oregon and Washington reported 3-hourly pressure tendencies of +9.8 mb. Portland reported +10.2 mb. for the period 1230–1530 GMT, October 27.

The second storm first appeared as a small low pressure center located about 100 miles north of Cold Bay, Alaska, with a weak cold front extending southwestward (fig. 5). By 0630 GMT, October 27, the Low had moved to a point near Station P, consolidated with an old Low that had been in the Gulf of Alaska, and deepened 16 mb. (fig. 6). The small upper air trough associated with the second storm is seen in figure 7 between Station P and the Aleutian Islands. The rapid eastward progress of the cold front associated with the second Low is seen by comparing figures 6 and 8. At approximately 2330 GMT, October 27, the winds behind the cold front were reported by the Lark Dog reconnaissance flight (San Francisco to Station P) to be 47 to 63 m. p. h. at 1,500 feet. Figure 9 illustrates the continued rapid sweep eastward of the cold front.

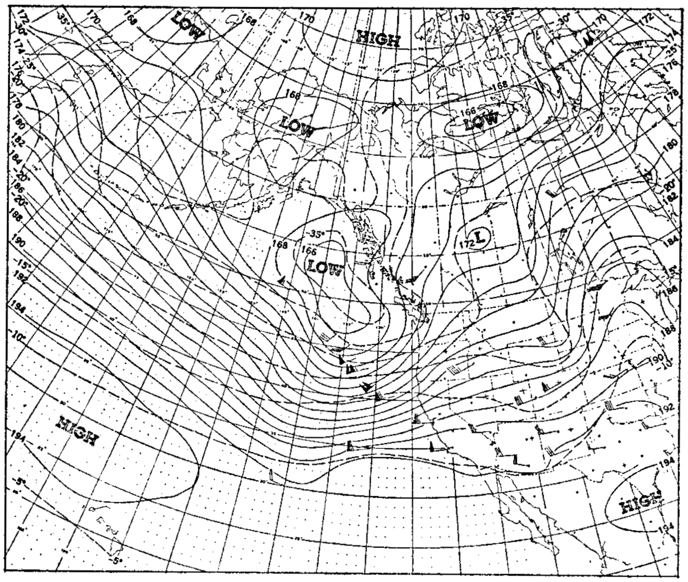

FIGURE 10.—500-mb. chart for 0300 GMT, October 28, 1950.

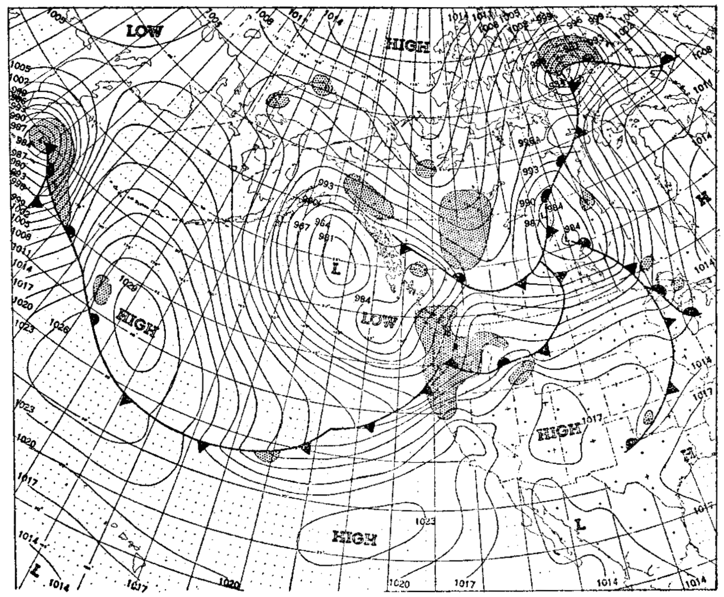

FIGURE 11.—Surface weather chart for 1830 GMT, October 28, 1950.

During the 12-hour interval between figures 8 and 9, the cold front moved 700 miles or at a speed in excess of 50 m. p. h. Whereas the low center of the first storm passed as far south as 41° N, the center of the second storm remained north of 48° N and reached the coast at Vancouver Island. Figure 10 shows the tongue of cold air at 500 mb., brought in with the second front, which set the record 500-mb. low temperature for October at Tatoosh.

The first of the small, stable waves that followed the second storm is seen in figure 9. Figure 11 shows the first and second waves, and the large area of precipitation along the Pacific coast.

The small, stable waves illustrated in figure 11 were followed by two other waves, one of which also reached the United States coast. Since none of the waves deepened significantly, and the low center at 49° N, 134° W gradually filled, the sea level pressure gradient along the Pacific coast weakened. This resulted in the abatement of strong winds and brought the regime to an end.

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